Abstract Submitted
for the MAR16 Meeting of
The American Physical Society

3D strain engineered self-rolled thin-film architecture for high-energy density lithium-ion batteries GRIFFIN GODBEY, CHEN GONG, CYNTHIA YU, CLAYTON BLYTHE, MARINA LEITE, Depart. of Materials Science and Eng. Institute for Research in Electronics and Applied Physics, Univ. of Maryland, College Park, MD — Recently, multiple 3D geometries have been implemented into energy storage devices (*e.g.* nanowire anodes and arrays of interdigitated rods) in order to better accommodate the large volume expansion experienced by the anode during lithiation and to increase the structure energy density. However, most approached structures are difficult to scale up. Here we show how self-rolled thin-films can maintain a high energy density and can potentially accommodate the volume expansion suffered by the anode. The self-rolled tubes are fabricated by physical deposition of the active layers, creating a stress gradient between thin-film stack due to differences in coefficient of thermal expansion. Upon a sacrificial layer removal, the thin-film rolls to relieve this built-in stress. We predict the final dimension of self-rolled battery tubes using known elastic properties of materials commonly used as the active layers of the device. We will discuss an appropriate figure-of-merit that defines how the winding process can ultimately affect the volumetric capacity of 3D self-rolled batteries.

Griffin Godbey
Depart. of Materials Science and Eng.
Institute for Research in Electronics and Applied Physics, Univ. of Maryland, College Park, MD

Date submitted: 27 Oct 2015 Electronic form version 1.4